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BUNT, OR STINKING SMUT OF WHEAT.

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Wheat is affected by two different types of smut: the loose smut, which destroys the entire head, transforming it into a powdery mass of black spores; bunt, or stinking smut, which affects only the berry, the other parts of the head remaining practically normal. There are two different species of bunt prevalent, but both affect the wheat in the same way and they can only be separated by a microscopic examination of the spores. Nearly all of the bunt reported has proved to be *Tilletia foetans,* the smooth-spored species, while *Tilletia tritici,* the rough-spored species, has been exceedingly rare.

PREVALENCE.

The bunt of wheat has been especially abundant in certain sections of the state during the past season. From

the number and character of the inquiries received it is apparent that the true nature of the disease and the preventive measures that should be employed are not well known by the farmers and grain dealers of the state.

Bunt has affected not only varieties of spring wheat, but it has been very prevalent in a large portion of the state where winter wheat varieties are grown. The accompanying map (fig. 1), based upon specimens examined, gives the distribution of the disease in the state.

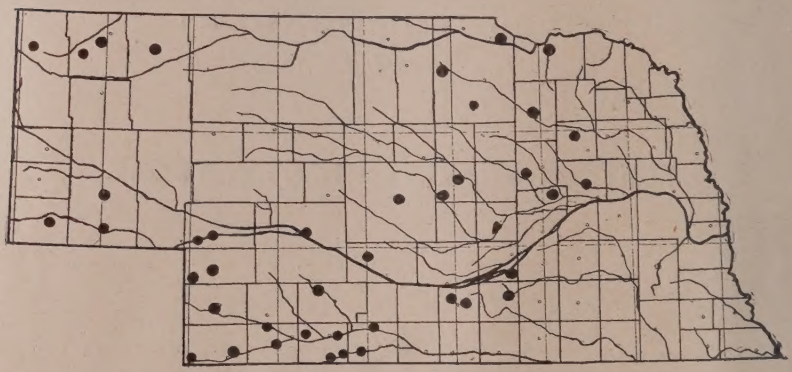

FIG. 1. Distribution of stinking smut in state during season of 1907, based on specimens examined.

Almost all of the samples received from south of the Platte river were of the Turkish Red variety, while the majority of samples from north of the Platte were spring wheat. Turkish Red wheat has generally been considered especially smut resistant, but the reports indicate that it will be necessary to treat seed of this variety for prevention of smut as well as in the case of spring wheat varieties. No samples of smutted wheat have been obtained from the eastern part of the state, but it has probably been present in small quantity.

EXTENT OF INJURY.

In some cases the smut has caused only a slight loss, while in others the loss has been serious. One correspondent reports, "Much wheat was too badly smutted for milling purposes." Another correspondent reported a loss of fifteen cents per bushel on sale price, without mentioning the added loss from reduction of yield. Figure 2 shows

FIG. 2. Separation of badly smutted sample of wheat. a, normal berries; b, smutted berries.

the separation of a badly smutted sample of wheat obtained in the western part of the state. This lot of wheat contained 9.08 per cent of smut by weight, 17.7 per cent by measure, and 21.93 per cent by count.

SYMPTOMS.

Bunt, or stinking smut, is not as noticeable in the field as the forms of loose smut, since it does not completely

destroy the head. Its presence in a field may be detected by the characteristic odor, by the deeper green of the affected heads, and generally by the fact that the glumes are more spreading than in normal heads. A closer examination will show in the place of the "normal" kernels the black smut "berries" of nearly the same shape covered with a thin membrane. A small smut-eating beetle is quite frequently present on the affected heads.

The smut may be very noticeable in the threshed grain or comparatively inconspicuous. In some cases the smut berries (fig. 3, b) are entirely broken up and the black powdery mass of spores which they contain is scattered and lodged upon the surface of the normal grains. These spores collect particularly in the groove and in the tuft of hairs or "brush" at the tip of the grain. Badly smutted wheat is frequently dark colored owing to the large number of spores collected upon the surface of the normal grains. When the smut berries are not broken they can easily be detected by their darker color, their plumper form with the obliteration of the groove and the fact that they can be easily crushed so as to exhibit the black powdery interior (fig. 3, d).

LIFE HISTORY OF THE FUNGUS.

Every spore which finds lodgment upon the surface of a grain of wheat is capable of reproducing the disease, and it is from these spores that the infection of the young wheat plant takes place. For this reason any seed treatment which will kill the spores of the smut without injuring the vitality of the wheat will be effective. Under normal conditions, the smut spores germinate soon after the young wheat seedling has started to grow. The spore produces a short, septate filament which forms one or more tufts of H-shaped sporidia. These sporidia either give rise to secondary oval sporidia (fig. 3, g) or pro-

FIG. 3. Stinking smut of wheat (*Tilletia foetans*). a, head of smutted wheat showing smutted "berries" protruding from between the glumes; b, smut berries; c, normal berries; d, smut berry, crushed to show the mass of black spores which fills the whole interior; e, normal berry, cut thru the middle; f, smut spores, much magnified; g, germinating spore, showing H-shaped sporidia, some of which have produced secondary sporidia. (Fig. g, redrawn from Pammel and King.)

duce infection threads direct which penetrate the tissues of the young seedling. After the smut fungus has gained an entrance into the seedling it grows upward thru the tissues of the stem but gives little external indication of its presence until the heads are produced, when it penetrates the berries or kernels and forms the characteristic smut "berries" which have been described. All of the heads produced by an infected stool are smutted, and generally all the berries of a smutted head are destroyed.

PREVENTION.

By seed treatment, the bunt of wheat and the smuts of oats can be almost entirely prevented, while the per cent of smut in barley, sorghum and rye can be very greatly lessened. While the hot-water treatment is effective, it is a rather laborious treatment to employ. The result is that it has been very largely superseded in this country by some of the chemical treatments. The principle of the chemical treatment is to use a poison which will kill the spores of the smut and not materially injure the germinating power of the seed. Out of many different chemicals tried up to this time, only a part have proven effective, such as potassium sulphid, corrosive sublimate, copper sulphate or bluestone, and formalin. During the past few years the use of formalin has very greatly increased, and the satisfactory results obtained justify its continued use.

Since the formalin steep is generally successful and easy to employ, it may be especially recommended. Formalin is a solution of formaldehyde, and the commercial article is 40 per cent. This strength is always understood in recommending the amount to be used in seed treatment.

The treatment of seed may be carried out as follows:

1. Place the seed to be treated upon the clean floor of the granary, or upon a canvas in the open, or in some other suitable place.

2. Prepare the solution of formalin by adding the commercial article to water in the following proportions: one pint to 30 gallons for bunt of wheat or loose smut of oats; and one pint to 20 gallons for barley or sorghum smuts. This solution should not be made up until it is needed for use, as it loses strength by standing.

3. Sprinkle the formalin solution over the seed, and shovel it over until the surface of each grain is thoroly moistened. For sprinkling the seed, a common garden watering pot may be used to good advantage.

4. Shovel the grain into a heap and cover with a canvas or wet sacks to prevent the evaporation of the formalin.

5. At the end of two hours, uncover and spread the grain out to dry. It will probably be necessary to rake or shovel the grain over several times to dry sufficiently to prevent germination. If treated in the granary, the floor should be sterilized with formalin solution before beginning operations. If the grain is to be returned to the same bin which it occupied before treatment, the bin should be sprayed or washed with formalin solution to prevent any reinfection taking place. For the same reason infected sacks should be avoided or sterilized.

The formalin treatment may be carried out in a slightly different way, and some may prefer it to the method already outlined. The writer has found the following method very satisfactory:

1. Prepare a solution of formalin of the strength indicated.

2. Put sufficient of the solution into a barrel to immerse a sack of seed (thirty-five to forty gallons).

3. Put seed to be treated into sacks (one and a half to two bushels) and dip each sack into the solution, allowing it to remain ten minutes.

4. Remove the sack and drain, allowing the excess of the steep to run back into the barrel. The solution should be replenished as often as necessary. The dipping can be very easily carried out by arranging the barrel so that a block and tackle can be employed for raising and lowering the sacks.

5. Set away in the wet sacks for two hours, or empty in a heap and cover with canvas or wet sacks as in the previous treatment.

6. At the end of two hours spread out to dry, taking pains to shovel over often enough to prevent germination.

Seed treated by either of the methods mentioned may be sown as soon as dry, or it may be stored in any suitable place if care is taken to avoid any reinfection.